FEDERAL REPUBLIC OF GERMANY

ISSUED ON
24TH JULY 1958

GERMAN PATENT OFFICE

PATENT
No. 969 838
CLASS 46 c[1] GROUP 8
INTERNAT. CLASS F 02 f

Dr. Ing. e.h. Karl Maybach, Friedrichshafen
was named as inventor

Maybach-Motorenbau G.m.b.H, Friedrichshafen

Multi-part internal combustion engine piston

Patented in Federal Republic of German as of 2nd February 1952
Patent application published on 18th October 1956
Grant of patent published on 10th July 1958

Simple screw joints are known for multi-part internal combustion engine pistons consisting at least of a main piston body and a head part, said screw joints being producible, releasable and removable from the piston head end, i.e. including when the piston is installed in the engine and the cylinder head is removed. However, these known screw joints have very short screws, such that transverse movements between the main piston body and the head part are virtually impossible. These screw joints are therefore not useful for heavily loaded internal combustion engines. This applies in contrast to joints with long expansion screws, which project a considerable distance into the main piston body. So that the main piston body does not become unnecessarily heavy, however, the tension force of the screws in the main piston body is transmitted via a spacer bushing to the main piston body. These screw joints cannot be produced, released and removed from the piston head end, however, but rather the piston has to be dismantled to enable access to the screw joint. An expansion screw joint is now known for flange joints which replaces part of the expansion screw with a bushing to avoid an unnecessary expansion length, said bushing having a cross-section which corresponds approximately to the expansion cross-section of the expansion screw.

According to the invention, on the one hand the advantages of these short expansion screw joints are exploited and, on the basis of the arrangement of the spacer bushing, on the other hand these known screw joints are adapted to this purpose in such a way that the joint is producible, releasable and removable from the piston head end.

The invention therefore relates to a multi-part internal combustion engine piston consisting at least of a main piston body and a head part, the two of which

are connected together by expansion screws via bushings through which the latter pass.

The invention consists in the fact that, in replacement for one part of the expansion length of the screw, the bushing has a cross-section corresponding approximately to the expansion cross-section of the screw and that this per se known screw joint is so constructed and arranged that it is producible, releasable and removable from the piston head end, i.e. including when the piston is installed in the engine and the cylinder head is removed. Such a screw joint is particularly well suited to high-speed internal combustion engines with a high specific power. It combines the advantage of a long expansion screw with ease of monitoring. It additionally withstands all force loads which originate from the piston pin and act on the pin bosses and the main piston body and generate bending stresses, as well ultimately as the thermal loads which arise as a result of the varying thermal expansion of the head part relative to the main piston body.

A particularly appropriate and advantageous arrangement may consist, for example, in the fact that the thrust bushing is supported axially and non-rotatably at its one end via an external thread in the flange terminating the main piston body and at its other end engages with an internal thread round the connecting screw in the manner of a nut.

It is particularly advantageous for the thrust bushing to be arranged movably, which is possible, according to a further development of the invention, in that a special ring bolt screwable into the flange of the main piston body supports the thrust bushing via a conical or spherical surface, while the reaction torque on the thrust bushing on tightening of the connecting screw is taken up by meshing teeth (chasing) on the thrust bushing and the main piston body.

A cap screw may advantageously be used as connecting screw.

Conveniently, a securing screw is arranged to secure the ring bolt against loosening.

As is the case with the known flange, the screw joint may project for the most part into the main piston body. However, it is convenient for the ends of the joint to project freely movably into blind holes, which are arranged in the main piston body. This has the particular advantage that, if the joint is loosened, any combustion gases passing through cannot reach the crankcase.

When the screw joint is arranged according to the invention, the thread and the shank are loaded virtually only by the pretension. It is therefore sufficient to provide significantly fewer screws for a piston, so making the piston lighter. The drawing is a schematic, mostly sectional representation of an exemplary embodiment of a screw joint according to the invention on a multi-part, pressure oil-cooled piston of an internal combustion engine.

1 is a main piston body, 2 a boss of the piston pin bearing, 3 a head part. 4 and 5 are cooling channels in the head part, 6 grooves for piston rings, 7 shim plates. 8 is a cap screw for connecting the main piston body 1 with the head part 3. The cap of the screw 8 is seated in a recess 9 in the head part 3. 10 is the shank of the screw 8 with an expansion length 21. 11 is the thread at the bottom end of the screw. This is screwed into the nut thread, which is arranged at the bottom end of the thrust bushing 12. The thrust bushing 12 has teeth (chasing) 13 at its top end, which engage in corresponding teeth in the main piston body 1. The upper end of the bushing 12 is of conical or spherical construction. A ring bolt 14, which is screwed into a flange 15 terminating the main piston body 1 at the top, supports the bushing 12 axially against the conical or spherical annular surface 18. 16 is a securing screw for the ring bolt 14.

As is clear from the Figure, the expansion length of the screw shank 10 has the dimension 21, while the length of the bushing, which is compression-loaded, exhibits the dimension 22. On pretensioning of the screw, these two dimensions are added together in known manner and allow a screw joint of short construction.

The invention is not restricted to the exemplary embodiment. Uptake of the reaction forces from the pretension in the main piston body and the corresponding construction of the screw joint have rather always to be such that the screw joint is loaded only by the pretension and any changes in the shape of the two parts relative to one another do not result in further loading.

CLAIMS

1. A multi-part internal combustion engine piston, consisting at least of a main piston body and a head part, the two of which are connected together by expansion screws via bushings through which the latter pass, characterised in that, in replacement for a part of the expansion length of the screw (8), the bushing (12) is dimensioned with a cross-section corresponding to the expansion cross-section of the shank (10) of the screw (8), and in that this per se known screw joint is so constructed and arranged that it is producible, releasable and removable from the piston head end, i.e. including when the piston is installed in the engine and the cylinder head is removed.

2. A piston according to claim 1, characterised in that the thrust bushing (12) is supported axially and non-rotatably at its one end via an external thread in the flange (15) terminating the main piston body (1) at the top and at its other end engages with an internal thread round the connecting screw (8) in the manner of a nut.

3. A piston according to claim 1 and claim 2, characterised in that a special ring bolt (14) screwable into the flange (15) of the main piston body (1) supports the thrust bushing (12) via a conical or spherical surface (18), while the thrust bushing (12) is prevented from turning during tightening of the connecting screw (8) for example by meshing teeth (chasing 13) on the thrust bushing (12) and the main piston body (1).

4. A screw joint according to claims 1 to 3, characterised by a cap screw (8) as connecting screw.

5. A piston according to claims 1 to 4, characterised by a securing screw (16), which secures the ring bolt (14) against loosening.

6. A piston according to claims 1 to 5, characterised in that the ends of the thrust bushing (12) project freely movably into blind holes, which are arranged in the main piston body (1).

Publications taken into consideration:
German patents, nos. 667 003, 704 518;
Swiss patent no. 171 458
French patents, nos. 570431, 571156;
"Untersuchung eines hochaufgeladenen Dieselmotors" (offprint from VDI journal, No. 36, 1951), p. 4, Fig. 8

---

1 page of drawings
